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## NOTES ON PHALAENINAE (LEPIDOPTERA)

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### GENUS **EUXOA** HÜBNER

Recently, with a view to testing the value of the female genitalia as a means of specific separation in this complicated genus, an investigation of these organs was initiated. Unfortunately, owing to the transference of my entomological activities from Ottawa to New York, this work had to be temporarily abandoned in its initial stage. However, such interesting results had already been obtained from a study of comparatively few North American species as to make it advisable at least to call the attention of lepidopterists to certain structural characters which appear to hold considerable value not only as a means of separating closely similar species but also as showing specific relationship.

The species examined consisted, roughly speaking, of the first 25 or 30 as placed in the 1938 "Check list." One of the outstanding features which strikes the investigator's eye is the position of the exit of the ductus seminalis from the bursa. Normally this originates on the left side of the bursa at or near the proximal end. In the *ridingsiana* group, however, it is found on the right side near the middle, linking up with the *subconspicua* group of Kozhantshikov's subgenus *Menada* (1937, Faune de l'URSS, Lepidoptères, vol. 13, no. 3, fam. Noctuidae [subfam. Agrotinae], pp. 526, 624). In *edictalis* Smith it occupies a unique position, arising from the fundus on the left side. This species further shows characters which were not met with in any other of the species studied, the bursa being U-shaped, bending to the left in its distal half, and possessing a small blind sac arising in the median section on the right side. Just how much value should

be placed on the shape of the bursa is, however, a matter that can be decided only after much further study, although Kozhantshikov uses this character extensively in his work on the Russian fauna. The feature on which, at the present time, it is desired to place particular emphasis is the character of the anal or ovipositor lobes. These show a surprising amount of variation but can be roughly divided into three categories. In the first type the lobes are completely covered with fine setae of variable length and thickness; such a condition is found in *olivia* Morrison, *laetificans* Smith, *brevipennis* Smith, and a number of other species. In the second type the lobes are supplied with thick, short spines, especially along the opposing edges; this feature is rarer but is well exemplified in *cicatricosa* Grote and Robinson and is very useful in correlating its various forms and separating it from closely similar species such as *quadridentata*, especially as the structure can be easily observed without the necessity of making a slide. In the third type the lobes terminate in short, non-setose, chitinous projections which frequently bend outward, the remainder of each lobe being finely setose. The size of these projections or knobs is quite variable, being short in *quadridentata* Grote and Robinson, better developed and somewhat outbowed in the *plagigera* group, and very strong in *cinereopallida* Smith, thus at once distinguishing it from *cicatricosa* with which it has been so often confused. The *ridingsiana* group also falls here on this character.

Using characters such as are above mentioned, I prepared a tentative key to the species studied. While in all likelihood this will stand in need of a certain amount of revision, it is presented at the present time as the best means of calling students' attention to characters which may readily prove to have considerable taxonomic value.

1. Ductus seminalis arising from right side of bursa. . . . . *ridingsiana* group
- Ductus seminalis arising from left side of bursa. . . . . 2
2. Ductus seminalis from fundus of bursa; finger-like sac attached to right side at middle. . . . . *edictalis*
- Ductus seminalis at or near proximal end of bursa. . . . . 3
3. Ovipositor lobes completely setose with more or less rounded apices. . . . . 4
- Ovipositor lobes terminating in short, chitinous, non-setose knobs, frequently divergent. . . . . 13
4. Ovipositor lobes furnished dorsally with heavy spines in apical and inner areas. . . . . 5
- Ovipositor lobes without heavy spines, finely setose dorsally with longer hairs at bases. . . . . 8

5. Heavy spines scattered over apical third or half of lobes; other spining weak.....6  
Heavy spines confined to an irregular row along inner margin of lobe; other spining stronger.....7
6. Spines short; a row of strong long setae across base of lobe.....*dargo*  
Spines longer and stouter; setal row at base of lobe composed of extremely fine hairs.....*melura*
7. Heavy spines arranged more or less in single row; ductus bursae only slightly exceeding apex of anterior apophysis.....*cicatricosa*  
Heavy spines more numerous and wider spread; ductus bursae longer, reaching well beyond apex of anterior apophysis.....*detersa*
8. Bursa bilobed, the left lobe half the size of the main bursa; anal lobes narrow and pointed; ductus bursae very long.....*flavidens*  
Bursa not bilobed; anal lobes less pointed.....9
9. Ductus bursae short and broad. Bursa long and rather narrow with slight median constriction.....*olivia*  
Ductus bursae long and narrow.....10
10. Ovipositor lobes weakly chitinized, clothed with fine setae.....11  
Ovipositor lobes more strongly chitinized with more numerous and thicker setae.....12
11. Bursa broadly oval, rather chunky. Ductus bursae entering on right side somewhat below apex of bursa.....*andera*  
Bursa broad in proximal third, narrowing to a long, finger-like section; entrance of ductus bursae more central on caudal margin of bursa.....*holleman*
12. Bursa chunkily oval; entrance of ductus bursae at right upper corner; ovipositor lobes moderately short with well-separated apices.....*brevipennis*  
Bursa longer and narrower with less prominent projection to left; ovipositor lobes narrow and approximate along inner margins.....*laetificans*
13. Lobes narrow and tapering, separated apically by a deep V-shaped incision.....14  
Lobes broader with less pointed apices and inner margins closely approximate.....15
14. Chitinized portion of ductus bursae long, extending far beyond apices of anterior apophyses. Bursa moderate, narrowing towards fundus.....*niveilinea*  
Chitinized portion of ductus bursae shorter, extending only to apex of anterior apophyses. Bursa much longer and narrower.....*xasta*
15. Chitinous knobs of lobes weak; ductus bursae short; bursa short, chunky.....*quadridentata*  
Chitinous knobs of lobes strong, the chitinization extending backward as a ridge along the opposed edges.....16
16. Lobes short and broad. Ductus bursae very short and broad, entering bursa on right side below apex.....*cinereopallida*  
Lobes narrower. Ductus bursae moderately long to very long. Apical knobs strongly chitinized and divergent.....17
17. Chitinous knobs joined together in median line. Ductus bursae reaching to

- apex of anterior apophyses and entering bursa on right side below apex  
 ..... *atristrigata*  
 Chitinous knobs separated apically..... 18  
 18. Ductus bursae scarcely extending beyond apex of anterior apophyses, enter-  
 ing bursa in upper right-hand corner..... *nevada*  
 Ductus bursae extending far beyond apex of anterior apophyses..... 19  
 19. Ductus bursae entering bursa on its caudal margin. Bursa with long,  
 narrow distal half..... *plagigera*  
 Ductus bursae entering bursa well down on right side. Bursa short and  
 chunky..... 20  
 20. Lobes short and widely separated when viewed ventrally..... *olivalis*  
 Lobes more closely approached on ventral side. Segment containing gen-  
 ital opening longer and narrower. In general very close to preceding  
 ..... *oblongistigma*

When more complete study can be devoted to the group it is probable that relationships will be disclosed that will result in considerable changes in the sequence of species as at present listed. For the present all that can be done is to call attention to some of the most obvious changes which have been brought to my attention partly as a result of this genitalic study and also during revisional work on the material in both the Canadian National and the American Museum collections.

### ***Euxoa detersa* Walker**

This very variable species should certainly be placed next to *cicatricosa* Grote and Robinson. The female ovipositor lobes show the same type of heavy spining found in *cicatricosa*, and there is very little tangible difference in the male genitalia. The species is widespread and essentially an inhabitant of sandy areas. The typical eastern seacoast form is fairly readily separable from *cicatricosa* and would appear to have slightly stronger fasciculations in the male antennae than those of the western species, but this feature may be inconstant. The maculation of the primaries varies greatly in any one locality from well-marked specimens with pale costa (typical) to unicolorous pale gray ones with obsolescent cross lines. Farther west the same species is found along the shores of the Great Lakes, and the name *azif* Strecker, based on material taken near Rochester, New York, may be used, if desired, for the form from the lower lakes region. It varies from gray to reddish in the coloration of the primaries, the latter color being that of Strecker's type, but apparently lacks the pale costa found in the type form. A series from Port



Colborne, Ontario, is held under this name in the Canadian National collection. *Personata* Morrison, listed as a race, was described from specimens from Illinois, taken by Dodge, and should probably be tied down to the much darker form that occurs in the sand-dune areas at the southern end of Lake Michigan. A very similar form occurs in the dune areas of Manitoba and Saskatchewan and especially in the latter province seems to merge into *cicatricosa*, extending northward through Montana from the semi-arid regions of the more southerly Rocky Mountain states. In fact, as yet, no definite distinguishing character has been found by which the two species may be separated, although the reduction of the frontal tubercle and the small pale round orbicular of *personata* are sometimes useful, as well as the darker border on the secondaries of the male.

#### ***Euxoa orbicularis* Smith**

The identity of this species, described from a single female from Nevada in the Tepper collection, now in the museum collection at East Lansing, Michigan, has always been a matter of doubt. After a careful study of an excellent photograph of this type it would seem best considered as one of the numerous forms of what is now known as *misturata* Smith and would take priority as the name of the species. The small, round orbicular, which gave rise to the specific name, is quite characteristic in this whole complex. A small series in the Canadian National collection from the Ivanpah Mountains, San Bernardino County, California, close to the Nevada border, seems to match Smith's description fairly well, the ground color of the primaries being considerably paler than that of typical *misturata* from Colorado. An examination of the ovipositor lobes of the type should be useful in verifying the above placement, as these show strong, outbowed, chitinous projections apically in *misturata* and its other forms.

#### ***Euxoa redimicula* Morrison**

Apparently two species have been masquerading under this name. As early as 1911 that keen observer F. H. Wolley Dod called attention to this (Canadian Ent., vol. 43, p. 396) in his notes on Alberta Lepidoptera and one cannot do better than repeat a portion of his text. He says, under the title *redimicula*: "The form occurring here [i.e., Calgary] is that figured by Sir

George Hampson from Colorado. Much the same form occurs in the East and I have a male from New York differing chiefly only in being browner and less grey. But a form occurring much more commonly in the East is more even in colour, has slightly larger and rounder discoidal spots, more even s.t. line without the inward streaks, and paler, dark margined secondaries. So unfamiliar did the form seem to my eye, that I made sure it was a distinct species. Mr. Winn has taken both forms flying together at St. Hilaire, Quebec and it was in his material that I first claimed to be able to recognize two species." He goes on to state that the more he examined the specimens the less able he was to draw a line between them but was still of the opinion that "the existence of two species [is] quite possible." How accurate his observations were has recently been proved by an examination of the ovipositor lobes of females of both types contained in the Canadian National collection (including Dod's long series) and in the American Museum collection. The two forms can readily be distinguished on easily seen characters found in the shape and spinulation of these lobes. In the case of the larger, darker, eastern form the apices of the lobes are produced into long, chitinous, slightly outcurved projections, the chitination being extended cephalad along the inner margins of the lobes for a considerable distance. The spinulation is heavy and consists of short, moderately stout setae, especially numerous along the latero-caudal edges when viewed dorsally. Along the cephalic margin of each lobe is a curved row of long setae, a character generally found in *Euxoa* species. The paler Calgary and Colorado form, which also extends into the east where it assumes a somewhat modified coloration, shows no projections of the apices of the lobes, these being rather bluntly pointed. The apical half of each lobe on the dorsal side is sparsely covered with extremely stout, short, rather bluntly pointed spines, interspersed occasionally with longer, finer ones. Towards the cephalic end of the lobes these spines diminish greatly in size and number. The usual row of long setae occurs just above the cephalic margin. In other structural details the whole genital organs show great similarity; a reference to figure 7 should elucidate these points.

When the fact that two distinct species are involved is recognized, it becomes a matter of considerable interest as to which of these species Morrison's name *redimicula* is applicable. The

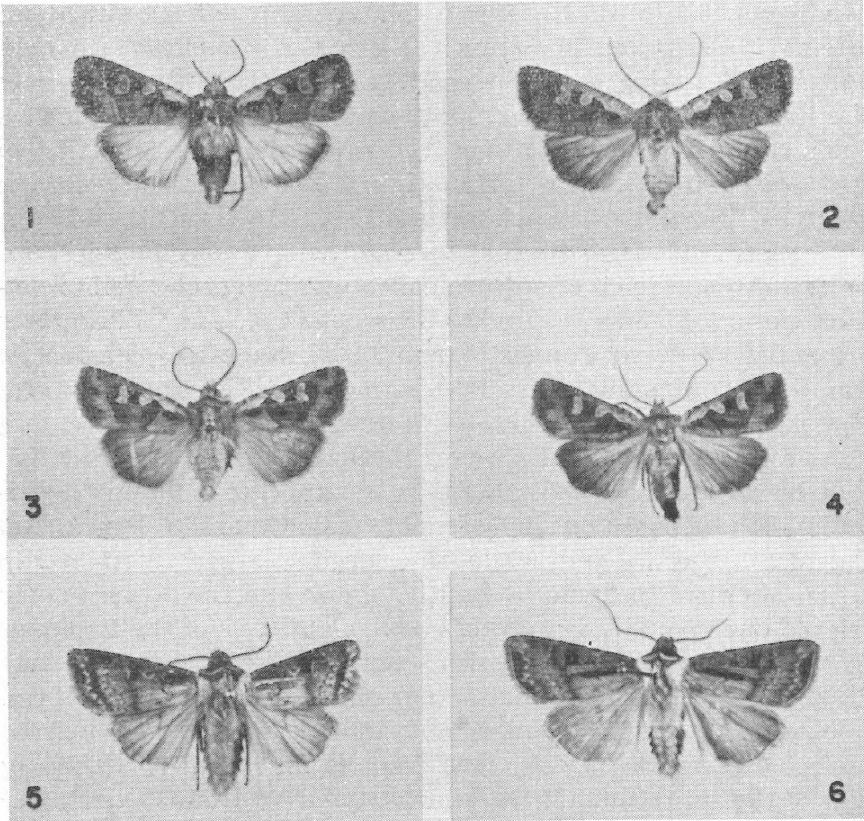


FIG. 1. *Euxoa redimicula* Morrison, male, Litchfield, Connecticut.

FIG. 2. *Euxoa redimicula* Morrison, female, Mystic, Connecticut.

FIG. 3. *Euxoa servita* Smith, male, Franconia, New Hampshire.

FIG. 4. *Euxoa servita* Smith, female, Orono, Maine.

FIG. 5. *Agrotis dentilinea* Smith, lectotype, male, "Sier. Nev. Cal."

FIG. 6. *Agrotis semiclarata* Grote, male, Kaslo, British Columbia.

original description is very brief and inadequate, stating: "Ground color cinereous, suffused with black. A large thick, basal, black dash. The ordinary spots and another costal spot at the base, clear cinereous, contrasting. *Claviform spot small* [the italics are mine]." The localities given are Colorado, Albany, New York, and Massachusetts, and most probably, therefore, the type series included specimens of both species. The reference, however, to a small claviform can apply only to the larger, darker, eastern form, and it is proposed to limit the name to this form, irrespective of any "type" that may still exist in the Tepper collection as stated by Smith (1893, Bull. U. S. Natl.



Mus., vol. 44, p. 107). A year later Morrison amplified his original description, changing the error of *redimacula* to *redimicula* and adding more eastern localities. He still emphasizes the "small black claviform spot" and makes no mention of a paler subterminal area, a feature very pronounced in Alberta and Colorado specimens. His original Massachusetts record is given as "Boston, Massachusetts (H. K. Morrison)," and as it would seem quite feasible for him to draw up an original description from a specimen of his own collecting it might be well to consider this specimen as typifying the true *redimicula*. The figures presented are from Connecticut material, but there is a female from Lenox, Massachusetts, in the American Museum of Natural History which matches these very closely.

As regards the second species, the name *servita* Smith (1895, Ent. News, vol. 6, p. 336, pl. 15, fig. 8) appears definitely applicable. It was based on single females from Colorado (Bruce) and Calgary, Alberta, and while the specimens are undoubtedly rather aberrant, judging by Smith's figure and the rather poorly colored one given by Hampson (1903, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 4, pl. 66, fig. 29) they show in general all the characters of this smaller, paler form. Rocky Mountain material is not difficult to distinguish from typical eastern *redimicula*; the color is much paler, especially that of the subterminal area, and, as noted by Dod, the indentations of the s.t. line are much more marked; it might be added that the t.a. line is generally more outwardly oblique, reducing the width of the median area on the inner margin considerably; the claviform is large and prominent. In the east the two species are much more difficult to separate, owing to the darker and less contrasting coloration of *servita* and the fact that none of the characters mentioned above seem to hold absolutely. Some males seem impossible to place definitely even when genitalic slides are studied, as the male organs present no appreciable differences. However, the direction of the t.a. line and the size of the claviform are very helpful as a means of separation in the large majority of specimens.

As regards the distribution the available data are insufficient to give a very definite picture. *Redimicula* occurs in the North Atlantic states quite commonly and extends northward through the New England states into southern Quebec (St. Hilaire) and southern Ontario (Chatham region). It has not been found as



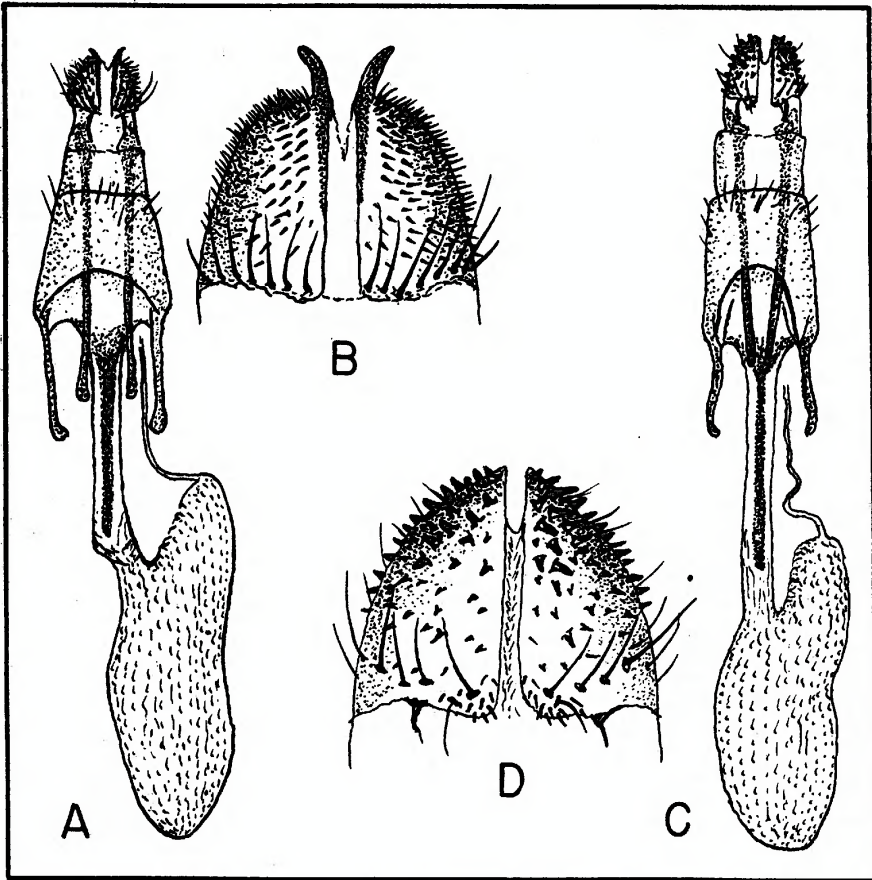


FIG. 7. A. *Euxoa redimicula* Morrison, female genitalia. B. The same, ovipositor lobes, enlarged. C. *Euxoa servita* Smith, female genitalia. D., The same, ovipositor lobes, enlarged.

yet in the Prairie Provinces of Canada but appears to occur in a modified form in the south-central section of British Columbia (Lillooet, Kamloops). Only limited material from this region has been available for study in the Canadian National collection, but the female ovipositor lobes certainly are of the *redimicula* type with slight reduction of the chitinous projections. The maculation, however, is very close to that of *servita* as regards the size of the claviform and the oblique nature of the t.a. line, and in consequence placement of these specimens is very puzzling and bears out very well Dod's remark already quoted.

*Servita* appears to be essentially a species of the prairie and Rocky Mountain regions. It is common and very characteristic throughout Manitoba, Saskatchewan, and Alberta and extends down the mountains through Montana and Wyoming into Colorado and Arizona. As far as can be told, its range in the east is more northerly than that of *redimicula*, being largely confined to the New England states, extending westward through Quebec and Ontario (Trenton, Nipigon) to connect with the paler prairie form. The specimens figured are from New Hampshire and Maine.

### ***Agrotis dentilinea* Smith**

A great deal of confusion has existed regarding the correct determination of this name. This was largely due to a very poor diagnosis (1890, Trans. Amer. Ent. Soc., vol. 17, p. 45) by Smith who neglected to state either the locality or the origin of "a number of specimens" which were "so different from the general run of specimens [i.e., of *volubilis*] that I applied the name *dentilinea* to the form." The only description given was that "the maculation is much more distinct, the colors brighter and the s.t. line very prominently dentate." While placed as a form of *volubilis*, Smith mentioned that it might "eventually prove distinct." Barnes and Benjamin (1924, Contributions to the natural history of the Lepidoptera of North America, vol. 5, no. 3, p. 114) mention that no types under the name *dentilinea* could be found in either the United States National Museum or the Smith collection at Rutgers University and state that "the name *dentilinea* may tentatively remain on lists as an unknown form of *volubilis*." In the 1938 "Check list" *dentilinea* was placed doubtfully as a form of *aeneipennis*, largely on the strength of a couple of specimens from the Wolley Dod collection in the Canadian National collection which had been labeled with this name.

While arranging the agrotid material in the American Museum collection I found three types of *dentilinea* which originally came from the Henry Edwards' collection and bore the locality label "Sier. Nev. Calif." These consisted of two males and a female and simply bore, besides the name, the designation "type," all in Smith's handwriting. One of the males can scarcely be distinguished from *volubilis* and does not agree well with the

diagnosis. The other male, however, agrees excellently and it is proposed to consider it as the lectotype; it shows the brighter coloration and the prominent dentate s.t. line mentioned by Smith; besides the locality and type labels it bears the museum label, No. 9888, used in cataloguing the Edwards' collection. Based on this specimen and the female type, which, while darker, is probably correctly associated, *dentilinea* can scarcely be associated with *aeneipennis* in which the thoracic squamation is evenly light brown, similar in color to the primaries. It would appear to show more relationship to *vancouverensis* Grote, especially to the so-called variety *semiclarata* Grote. The head and the basal half of the tegulae show the same dark brown coloration with a white subapical line crossing the latter; the patagia are also pale. The primaries are broadly dark brown along the costa from base to just before the apex. The inner half of the wing below the cell is pale purplish white as far as the t.p. line, this color then extending upward as a narrow band, exterior to the line, as far as the dark costal area. The claviform is scarcely marked and shows no black, basal extension which would seem, if constant, to distinguish it from *vancouverensis* forms. The pale, dentate s.t. line is very strongly marked and is completely bordered inwardly by a narrow dark band of the same shade as the costal area on which black arrow marks are faintly discernible. The apex of the wing is pale shaded, but the balance of the terminal area is dark. The small orbicular is outlined in whitish but the reniform is scarcely more than indicated by a pale upright streak on its inner edge; between the two spots is a blackish shade. The t.a. and t.p. lines are single, blackish, the former with a strong outward loop above the inner margin, the latter dentate. A broad, upright, dark, median shade is evident crossing the paler portion of the wing, adjacent to the t.p. line. The secondaries are smoky but noticeably paler in the basal half as in *semiclarata*. The figure given should render identification fairly easy.

The exact status of *dentilinea* cannot be determined until more study has been given to the extremely complex *vancouverensis-volubilis* group, but its association with *vancouverensis* as a Sierran race can do no harm. As regards a more definite type locality than that given on the label the vicinity of Truckee might be mentioned, as it is well known that Henry Edwards collected a good deal in this area along with McGlashan.



***Feltia repleta* Walker**

A single male of this species was found among the series of *annexa* Treitschke, taken by Mrs. Slosson years ago at Biscayne Bay, Florida; the species must therefore be added to our lists. The male antennae are bifasciculate, the fascicles much shorter than in *annexa*. The general appearance would indicate a position next to this species.

***Protopygia lagena* Grote**

Doubt was expressed in a former paper (1932, Canadian Ent., vol. 64, p. 108) as to whether the types of this species in the British Museum were authentic, as they were listed by Hampson as from "Nevada," whereas the original description gave "California, Hy. Edwards, No. 2256" as the data on the type specimen. A worn female specimen bearing both Edwards' number and "California" in small print as well as a red-bordered label with the name of the species in Grote's handwriting but not marked "Type" is in the American Museum collection. Unfortunately the number 2256 in the original Edwards' catalogue gives the locality as "Virginia City, Nevada, W. T. Eaves" and thus obscures the entire issue. However, the identity of the species, as established in the above paper, is not changed, and it might be well to accept the British Museum specimens as the correct types. The Edwards' collection contains further a small series labeled "Sierra Nev. Cal." which probably were collected in the region around Truckee and therefore quite close to Virginia City which might partially explain the locality mixup.

***Abagrotis baueri*, new species**

Resembles closely the recently described *Abagrotis denticulata* McDunnough but is slightly smaller in size and with rather smoother appearing primaries, owing to the reduction of the fine blackish sprinkling. On male genitalic characters the species is very close to *barnesi* Benjamin, differing in the armature of the aedeagus.

Palpi with the second joint deep blackish outwardly, the third joint ochreous. Male antennae simple. Vestiture of head and thorax concolorous with the primaries, being a light wood brown color, but at times this is lacking and the wing then appears to be more of a deep fawn brown; the black sprinkling is slight. The t.a. and t.p. cross lines are quite indistinct, being geminate,

blackish, with filling uncontrasted from the ground color; their course is much as in *denticulata* and *barnesi*. The pale s.t. line is irregular, defined by slight smoky shading on the inner side, most prominent at costa; its course is much as in the allied species. Orbicular small, circular, inconspicuous; it is outlined by a pale ring, only slightly paler than the ground color, and shows little trace of darker filling (useful in distinguishing from *denticulata*). Reniform narrow, upright, outlined in dull ochreous and with black filling in the lower half which at times spreads over the whole interior portion. Above the reniform is a small black mark on costa, the inception of the inner portion of the geminate t.p. line. A terminal series of black spots of variable intensity. Fringes smoky with a few whitish sprinkles and a light ochreous basal line. Secondaries deep smoky. Fringes much paler, shading from a light ochreous basal area to whitish outwardly and crossed by a dark median line. Beneath the primaries are smoky with costa to postmedian dark dash tinged with ochreous; secondaries ochreous with black sprinkling in costal portion, smokier on the inner area; a large, dark discal spot, at times angled, and traces of a postmedian curved line; fringes as above. Expanse 33–35 mm.

The male genitalia are closely similar to those of *barnesi* except in the armature of the vesica. In *barnesi*, as well figured by Benjamin, this consists of a single or bifid spine, projecting beyond the apex of the aedeagus as an extension of a chitinous plate, the left side of which is in alignment with the spine. In the present species the armature is internal and does not project; it consists of a single or bifid spine, attached to the middle of a broad, spreading, chitinous plate, the whole being of the rose-thorn type. The apex of the aedeagus is squarely truncate, and the median section shows a distinct striated area. The twisted, apical, hammer-like portion of the clasper is slightly narrower than in *barnesi* and the whole organ somewhat smaller, although distinctly larger than that of *denticulata*. Judging by several slides made of both *barnesi* and the present species the above differences appear quite constant.

Holotype, male, Anderson Springs, Lake County, California, July 13, 1947 (W. R. Bauer) in the American Museum of Natural History.

Allotype, female, same locality and collector, August 17, 1947, also in the American Museum of Natural History.

Paratypes, six males, three females, same locality and collector; males dated August 3, 9, 10, September 14, 28; females, August 3, 17, September 13. Of these two males and a female will be returned to W. Bauer and another pair deposited in the Canadian National Collection.

The type material was submitted by W. R. Bauer of Petaluma, California, along with specimens of *denticulata*, for identification. It is with much pleasure that the species is named after this enthusiastic collector. There is a possibility that the specimen figured by Benjamin (1920, Bull. Southern California Acad. Sci., vol. 19, pl. 6, fig. 47) as a form close to *barnesi nevadensis* from Mission San Jose, California, belongs to this species.